FORMATION OF A TEAM OF PROJECT EXECUTORS IN THE AREA OF CREATION AVIATION TECHNIQUES

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Abstract: In the article there is analyzed the present condition of the problem of high-tech project management to develop the new objects by the aviation profile enterprises. The analyses showed that for improvement of the efficiency of portfolio management it should be developed special methodic tools of decision support system by HR and Project managers about executors' composition forming of high-tech projects taking into account number of indicators of different character and first of all employee competence.

Based on the analyzed results the integrated process model was developed which described the main stages of team formation of high-tech projects executors. There is formation of expert committee of employees of aviation profile enterprises for the choice of rational variant of team composition from the several alternatives; estimation of the candidates' competencies level for the including to the high-tech project team, the communication level assessment of the future team participants, selection by the collective expert estimation, united variant of executive team of high-tech project. This model provides increasing of the level of objectivity of finally decision about composition of team executors of high-tech project unlike other famous models. Practical value of proposed model is in decreasing of the risks of incorrect decision making by HRs and project managers during the process of formation of team executors of high-tech project.

Based on developed methodical tools, in the article there is described process of formation of team executors of high-tech project on the typical aviation profile enterprises PF "Space". This company is specialized on development of airdrome techniques in particular self-propelled passenger ladder. Also in this article there are described methods and computation effect from integration of theoretical results into the practice of management by the high-tech projects on the aviation profile enterprises.

Practice value of received results is in creation of science methodic basis in aggregate models view and methods of decision making support of HR and project managers for the formation of team executors' composition of high-tech projects. These results can be used in portfolio management not only on the aviation profile enterprises but in any other innovation companies.

Keywords: aviation profile enterprises, high-tech project, competency-oriented assessment, complex process model.

1. Introduction

Efficiency increasing of functioning of high-tech enterprises which includes aviation profile enterprise foresees the problem solving of team formation by colleagues whose level of competences will provide effective realization of high-tech project on the one side. But on the other hand, it carries out the rational distribution of human resource with purpose of the efficient realization of the all portfolio projects of the aviation profile enterprise [1]. In this article there are described results of model development and methods of support decision making of HR and project managers to formation of team executors composition of high-tech projects on the aviation profile enterprise.

Specifics of the high-tech projects define the necessity of number of special methods appliance, which based on the principles of competence approach at the pretenders' choice on the including to the team of high-tech project [2, 3]. The latest years in Ukraine and abroad there were published a lot of papers conducted to the problem of efficiency increasing in functioning of high-tech projects using competence approach.

The decision of indicated problem is impossible without objective accounting of different points of view of specialists-experts, whose knowledge and experience were formed by long-terms work on organization and realization high-tech projects on the aviation profile enterprises. Several last years there were published science works, so like as [4–6], which describe ways of construction of special theory of multicriteria decision making in conditions of uncertainty based on the utility theory. Application of this approach defines of necessity of addition of existent methodic by special stages for the forming of executors' team of high-tech projects. On these stages it will be collection of experts' information, it analyses and processing with purpose of improve efficacy of decision objectivity which are made about pretenders' selection on including to the team of high-tech project and also formation of executors' team [7].

So, development of the methodic tools complex which will provide improvement of reliability of management of high-tech projects on aviation profile enterprises [8–10] as the part of human resource management by reduction of the level of uncertainty actual is a scientific problem. The decision of this problem will improve efficacy of process of formation of team composition of executors of high-tech projects during objects creation of new technique at the expense of using of the internal reserve of the aviation profile enterprise.

2. Methods

During the research it was proposed integrated process model for regulation of process of formation of team executors of high-tech projects on aviation profile enterprise. At the beginning of the process there are lists of pretenders on including to the project team and as the output is formed project team. The process of team formation is intend of realization of the next stages: formation of the requirements to pretenders; formation of the base of pretenders; estimation of personal qualities and level of competences of pretenders based on the competency approach; estimation of communication opportunities of pretenders on including in team of high-tech project with using of fuzzy logic by the way of pair wise comparison of cooperation opportunity by pretenders within the framework of one team; formation of alternative variants of project team composition from selected candidates; receiving of individual experts evaluations by alternatives; estimation of the extent consistency of results of collective expert review and according of level of consensus of experts evaluation is apply method by Dempster-Shafer (in case of absolutely original alternatives) or method of Dezert-Smarandache (in case of single identity of different alternatives). The process of team formation involves argumentations base foundation with using of rough set theory about changes in experts' commission composition if the results of their activity will be negative.

For the formation of generalized evaluation of experts' commission activity results about choice of variants of team executors' compound of high-tech project.

Theoretical base for this is the chain of several special theories. There is evidence theory by Dempster-Shafer, theory of plausible and paradoxical reasoning by Dezert-Smarandache and rough set theory.

Let's consider that experts' evidence presents in numerical with using of absolutely scale. Then in formalization view the procedure of receiving generalized result of experts' work can be described in the next interpretation:

$$(X_{ij}) = \begin{pmatrix} x_{11} & x_{12} & \dots & x_{1j} & \dots & x_{1n} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ x_{i1} & x_{i2} & \dots & x_{ij} & \dots & x_{in} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mj} & \dots & x_{mn} \end{pmatrix} \Rightarrow \begin{matrix} \\ \\ \Uparrow \\ \\ [\pi_1] \end{matrix} \begin{pmatrix} X_1 \\ \dots \\ X_j \\ \dots \\ X_m \end{pmatrix} \Rightarrow \begin{matrix} \\ \\ \Uparrow \\ \\ [\pi_2] \end{matrix} X_{gee}, \quad (1)$$

where is the each element x_{ij} of the matrix X_{ij} is marked of the i-experts by the j-variant of team executors by high-tech project (i=1,…, m; j=1,…, n);

$$X_j = \{x_1, x_2, ..., x_j, ..., x_m\}$$

is aggregated of experts' personal evaluations by j-variant; X_{gee} is generalized experts' evaluation; $[\pi_i]$ is operator of processing by the experts personal evaluations which is ordered a set of methods for collective expert assessment.

Procedure realization is provided for implementation of the next steps:

1. The formation of the commission of experts

$$E = \{E_j \mid j = \overline{1,m}\}.$$

2. Set presentation $A = \{A_i \mid i = \overline{1,n}\}$ to the members of experts commission and receiving of the set of personal experts' assessments

$$X_j = \{x_1, x_2, ..., x_j, ..., x_m\}.$$

3. The check of set X_j on consensus in personal experts' assessments. If the number of experts is not more than two, then level of consensus estimates like a coefficient of Spearman's rank correlation. Otherwise the level of consensus estimates like a coefficient of Candel-Smith concordance.

4. If the level of consensus by the personal assessments is admissible, then the calculation of the overall scale by the value averaging of set elements

$$X_j = \{x_1, x_2, ..., x_j, ..., x_m\}$$

basis on Cemen's median

$$\text{Arg} \min_a \sum_{i=1}^{l} d(a_i, a).$$

5. If the level of consensus of the personal experts assessments is insufficiently then passes of alternatives ranking

$$R_{tot} : \{A_1 \succ A_2 \succ \dots \succ A_j \succ \dots \succ A_n\} \vee$$
$$\vee \{A_1 \succ A_2 \sim A_3 \succ \dots \succ A_{j-1} \sim A_j \succ \dots \succ A_n\}$$

and estimations of the compatibility level. If the experts' evidences are separate (untied) then recast of experts commission.

6. Depending to level of compatibility of the experts' evidences applies by the Dempster combining rule or following of the conjunctive consensus basis on the Dezert-Smarandache combining rule.

7. Calculation of the overall scale X_{gee} by the total result of commission work.

So method of formation of the overall scale of estimation of composition variants of team executors of high-tech project on the aviation profile enterprises was synthesized. The method includes three types of situations in experts' commission work, when the assessments of individual experts are agreed or consistent or untied.

For the precision (efficacy) definition of the total estimating of experts; commission of composition of high-tech project there were used an approach which is based in calculation of reliability in the form of "truncated mean". That it so called index which characterizes quality of structuration and following aggregation of estimates which received by the expert's commission. Mean-square error of the truncated mean is:

$$e_{T(\alpha)} = \sqrt{\frac{SS(\alpha)}{(n-2g)(n-2g-1)}}, \quad (2)$$

where n – the data sample size which assesses; the value of g definition by the ratio g=[αn]; [αn] – the largest integer among values of sample; $SS(\alpha)$ – sum of squares of deviations.

The feature of this approach is that the mean-square error of the truncated mean depends of evaluable data sample size (the bigger sample size, the less mean-square error). Mean-square error measures in the same units that standard deviation. So the less value of the mean-square error is more effective and more precision to estimate truncated mean and accordingly the quality of collective experts' estimation of alternative variants of high-tech project team.

3. Results

In the researching process there were developed several methodology tools which raise the effective of process of formation of project team consisting on establishment of objects of new techniques on aviation enterprise type.

The calculation of efficiency of these methods was realized on the example of creation of new model of self-propelled passenger ramp SPT-154 on the typical enterprise of the aviation type PF "Space".

By the results of the analyze of the staff PF "Space" taking into account employment of the staff were formed the team of the 7 people $E = \{E_i \mid i = \overline{1,7}\}$, whose qualities gave opportunity to realize estimation of variants alternative of team composition of developers of mooring complex equipment. Theoretically experts can be not only company employees but involved experts, too if the TOP-management of the company will find this way advisable.

In progress of experts' commission work there were necessary to estimate the alternatives which were formed by HR $A_i \in K$, $i = \overline{1,12}$ or found the best alternative groups

$$X_k = \left\{A_i \mid i = \overline{1,s}\right\}, \quad s \le 12, \quad X_k \subseteq K.$$

After that it was defined the level of privileges in the frame of the given scale according to each of other alternatives of team composition of developers of mooring complex (at the set K).

In the result of experts' interview were found groups of alternative $X_k \subseteq K$ from the set K and it was defined level of privileges found groups of alternative (**Table 1**).

Table 1

The value of the measures of the average level of assessments of the options for the composition of the mooring complex equipment of development team considered by the expert committee

Index of expert's estimation	Alternative variants of the team composition											
	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}
α– truncated mean	37	50,8	56,2	40,4	42,8	52,3	81,9	64,1	50,1	50,5	57,2	42,8

The value of α – truncated mean which described in the **Table 1** gave opportunity to define the variant of team A_3 such as most advisable, because only of this cluster inside the estimate of experts were found similar and agreed and that's why the most reliable. The results were received by the ranking and clustering of the expert's estimations.

4. Discussion

The calculation of efficiency of developed methods was realized on the example of creation of mooring complex equipment for the SPT-154, at the same time was used the method of α – truncated mean. Calculation gave opportunity to choose variant of team composition developers of mooring complex equipment from 12 alternative variants with the biggest value of reliability function. Applying of designed results had improved of reliability of evidence base for person, which makes decision about the ratification of the final team composition of developers of mooring complex equipment due to consecutive reduce of the level of uncertainty in the aspects of imperfection, fuzziness and inaccuracy.

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